Joule

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The **joule** (symbol **J**), named for James Prescott Joule, is the derived unit of energy in the International System of Units. It is the energy exerted by a force of one newton acting to move an object through a distance of one metre. In terms of dimensions:

$$1\,\mathrm{J} = 1\,\mathrm{kg} \cdot \mathrm{m}^2 \cdot \mathrm{s}^{-2}$$

Contents

Definition

One *joule* is defined as the amount of work done by a force of one newton moving an object through a distance of one metre. Other relationships are:

- The work required to move an electric charge of one coulomb through an electrical potential difference of one volt; or one *coulomb volt* (C·V). (This relationship can be used to define the volt);
- The work required to continuously produce one watt of power for one second; or one *watt second* (W·s) (compare kilowatt hour). (This relationship can be used to define the watt)

Conversions

1 joule is equal to:

- 1×10^7 ergs (exactly)
- $6.241\,509\,74 \times 10^{18}$ eV (electronvolts)
- 0.2390 cal (thermochemical gram calories or small calories)
- 2.3901×10^{-4} kcal (thermochemical kilocalories, kilogram calories, large calories or food calories)
- 9.4782×10^{-4} BTU (British thermal unit)
- 0.7376 ft·lbf (foot-pound force)
- 23.7 ft·pdl (foot-poundals)
- 2.7778×10^{-7} kilowatt-hour
- 2.7778×10^{-4} watt-hour
- 9.8692×10^{-3} litre-atmosphere
- 1×10^{-44} Foe (exactly)

Units defined in terms of the joule include:

- 1 thermochemical calorie = 4.184 J
- 1 International Table calorie = 4.1868 J
- 1 watt hour = 3600 J
- 1 kilowatt hour = 3.6×10^6 J (or 3.6 MJ)
- 1 ton TNT = 4.184 GJ

Useful to remember:

- 1 joule = 1 newton × 1 metre = 1 watt × 1 second

Practical examples

One joule in everyday life is approximately:

- the energy required to lift a small apple one meter straight up.

- the energy released when that same apple falls one meter to the ground.
- the energy released as heat by a person at rest, every hundredth of a second.
- the energy required to heat one gram of dry, cool air by 1 degree Celsius.
- one hundredth of the energy a person can receive by drinking a drop of beer.
- the kinetic energy of an adult human moving at a speed of about a handspan every second.

SI multiples

SI multiples for joule (J)

Submultiples			Multiples		
Value	**Symbol**	**Name**	**Value**	**Symbol**	**Name**
10^{-1} J	dJ	decijoule	10^{1} J	daJ	decajoule
10^{-2} J	cJ	centijoule	10^{2} J	hJ	hectojoule
10^{-3} J	**mJ**	**millijoule**	10^{3} J	**kJ**	**kilojoule**
10^{-6} J	**µJ**	**microjoule**	10^{6} J	**MJ**	**megajoule**
10^{-9} J	**nJ**	**nanojoule**	10^{9} J	**GJ**	**gigajoule**
10^{-12} J	**pJ**	**picojoule**	10^{12} J	**TJ**	**terajoule**
10^{-15} J	fJ	femtojoule	10^{15} J	PJ	petajoule
10^{-18} J	aJ	attojoule	10^{18} J	EJ	exajoule
10^{-21} J	zJ	zeptojoule	10^{21} J	ZJ	zettajoule
10^{-24} J	yJ	yoctojoule	10^{24} J	YJ	yottajoule
Common multiples are in bold face					

This SI unit is named after James Prescott Joule. As with every SI unit whose name is derived from the proper name of a person, the first letter of its symbol is uppercase (**J**). When an SI unit is spelled out in English, it should always begin with a lowercase letter (**joule**), except where *any* word would be capitalized, such as at the beginning of a sentence or in capitalized material such as a title. Note that "degree Celsius" conforms to this rule because the "d" is lowercase.

—Based on *The International System of Units (http://www.bipm.org/en/si/si_brochure/chapter5/5-2.html)*, section 5.2.

See also

- Conversion of units
- Orders of magnitude (energy)
- Fluence

References

- The adoption of joules as units of energy (http://www.fao.org/docrep/meeting/009/ae906e/ae906e17.htm), FAO/WHO Ad Hoc Committee of Experts on Energy and Protein, 1971. A report on the changeover from calories to joules in nutrition.

External links

- Unit conversion from joule (http://formularium.org/?go=122)
- Online Joule Converter (http://www.imperialtometric.com/conversion_en.htm)
- Joule in E=mc² (http://www.worsleyschool.net/science/files/emc2/emc2.html)